

IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strike through~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

1. (currently amended) An apparatus comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

a ridge relation obtaining unit obtaining relation of a ridge containing a vicinal feature point near a feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

a matching unit performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point to be checked in the matching process, and, wherein when said first and second fingerprints match in ~~at least one of~~ all of position, type, and direction associated with a ridge direction of the vicinal feature points where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are the same feature points.

2. (previously presented) The apparatus according to claim 1, wherein information about the feature point has a format comprising an identifier assigned to each feature point and corresponding feature information about the feature point.

3. (original) The apparatus according to claim 1, wherein when a number of ridges from the feature point to be checked to a ridge containing the vicinal feature point, and when feature information about the vicinal feature points matches in a predetermined range, it is determined that feature points to be checked contained in the first and the second fingerprints are same feature points.

4. (previously presented) The apparatus according to claim 1, wherein in said first and second fingerprint, when feature information about the vicinal feature points matches in a predetermined range, a number of ridges between the feature point to be checked and a ridge containing the vicinal feature point matches a value obtained by counting a number of ridges in an opposite direction from the feature point to be checked to the vicinal feature point, and a number of ridges between the feature point to be checked and a ridge containing the vicinal feature point matches a value obtained by counting a number of ridges in a direction from the feature point to be checked to the vicinal feature point, it is determined that feature points to be checked contained in the first and the second fingerprints are same feature points.

5. (cancelled)

6. (original) The apparatus according to claim 1, wherein when said feature points to be checked match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

7. (original) The apparatus according to claim 1, wherein when said vicinal feature points match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

8. (original) The apparatus according to claim 1, wherein when said feature points to be checked are different in type in said first and second fingerprints, a matching process is performed by changing relation between ridges containing the feature points to be checked and ridges containing the vicinal feature points.

9. (currently amended) An apparatus comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

a virtual feature point generation unit generating a virtual feature point by referring to first and second feature points;

a ridge relation obtaining unit obtaining relation of a ridge containing a virtual vicinal feature point near a feature point to be checked in a matching process performed on the first

and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

a matching unit performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process and comparing vicinal feature points of the first and second fingerprints, and wherein when said first and second fingerprints match in ~~all at least one~~ of position, type, and direction associated with a ridge direction of the vicinal feature points where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

10. (previously presented) The apparatus according to claim 9, wherein information about the virtual feature point has a format comprising an identifier assigned to each virtual feature point and corresponding feature information about the virtual feature point.

11. (original) The apparatus according to claim 9, wherein when a number of ridges from the feature point to be checked to a ridge containing the virtual vicinal feature point, and when feature information about the virtual vicinal feature points matches in a predetermined range, it is determined that feature points to be checked contained in the first and the second fingerprints are same feature points.

12. (original) The apparatus according to claim 9, wherein when said first and second fingerprints match in at least one of position, type, and direction of the virtual vicinal feature points, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

13. (original) The apparatus according to claim 9, wherein when said feature points to be checked match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

14. (original) The apparatus according to claim 9, wherein when said virtual vicinal feature points match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

15. (original) The apparatus according to claim 9, wherein said virtual feature point is generated by projecting an existing feature point to a vicinal ridge.

16. (original) The apparatus according to claim 15, wherein feature information about the virtual feature point is feature information about a feature point from which a virtual feature point is projected.

17. (original) The apparatus according to claim 9, wherein when said feature points to be checked are different in type in said first and second fingerprints, a matching process is performed by changing relation between ridges containing the feature points to be checked and ridges containing the vicinal feature points.

18. (currently amended) An apparatus comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

a virtual feature point generation unit generating a virtual feature point by referring to first and second feature points;

a ridge relation obtaining unit obtaining relations of a ridge containing a vicinal feature point near a feature point, and a ridge containing the virtual vicinal point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

a matching unit performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process, and performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process and comparing vicinal feature points of the

first and second fingerprints, thereby determining whether or not the feature point to be checked is matching, and wherein when said first and second fingerprints match in ~~all at least one~~ of position, type, and direction associated with a ridge direction of the vicinal feature points where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

19. (original) The apparatus according to claim 18, wherein
when said feature point to be checked matches in position and direction in said first and second fingerprints in a predetermined range, but does not match in type, evaluation of a matching result is set low.

20. (original) The apparatus according to claim 18, wherein
when said vicinal feature point or said virtual feature point matches in position and direction in a predetermined range in the first and second fingerprints, but does not match in type, evaluation of a matching result is set low.

21. (original) The apparatus according to claim 20, wherein
a matching process is performed on a combination of the vicinal feature point of said first and second fingerprint and the virtual feature point.

22. (original) The apparatus according to claim 18, wherein
when said first and second fingerprints match in feature points to be checked and said vicinal feature points match several times for the feature points to be checked, evaluation of a matching result is enhanced depending on a number of matching results.

23. (currently amended) A method for comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

obtaining relation of a ridge containing a vicinal feature point near a feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing a feature point to be checked in the matching process; and

performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation

of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process and comparing vicinal feature points of the first and second fingerprints, and wherein when said first and second fingerprints match in ~~all at least one~~ of position, type, and direction associated with a ridge direction of the vicinal feature points where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

24. (original) The method according to claim 23, wherein information about the feature point has a format comprising an identifier assigned to each feature point and corresponding feature information about the feature point.

25. (original) The method according to claim 23, wherein when a number of ridges from the feature point to be checked to a ridge containing the vicinal feature point, and when feature information about the vicinal feature points matches in a predetermined range, it is determined that feature points to be checked contained in the first and the second fingerprints are same feature points.

26. (previously presented) The method according to claim 23, wherein in said first and second fingerprint, when feature information about the vicinal feature points matches in a predetermined range, a number of ridges between the feature point to be checked and a ridge containing the vicinal feature point matches a value obtained by counting a number of ridges in an opposite direction from the feature point to be checked to the vicinal feature point, and a number of ridges between the feature point to be checked and a ridge containing the vicinal feature point matches a value obtained by counting a number of ridges in a direction from the feature point to be checked to the vicinal feature point, it is determined that feature points to be checked contained in the first and the second fingerprints are same feature points.

27. (original) The method according to claim 23, wherein when said first and second fingerprints match in at least one of position, type, and direction of the vicinal feature points, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

28. (original) The method according to claim 23, wherein when said feature points to be checked match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

29. (original) The apparatus according to claim 23, wherein when said vicinal feature points match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

30. (original) The apparatus according to claim 23, wherein when said feature points to be checked are different in type in said first and second fingerprints, a matching process is performed by changing relation between ridges containing the feature points to be checked and ridges containing the vicinal feature points.

31. (currently amended) A method for comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

generating a virtual feature point by referring to first and second feature points;

obtaining the relation of a ridge containing a virtual vicinal feature point near a feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for a relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process and comparing vicinal feature points of the first and second fingerprints, and wherein when said first and second fingerprints match in ~~all at least one~~ of position, type, and direction associated with a ridge direction of the vicinal feature points where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

32. (previously presented) The method according to claim 31, wherein information about the virtual feature point has a format comprising an identifier assigned to each virtual feature point and corresponding feature information about the virtual feature point.

33. (original) The method according to claim 31, wherein when a number of ridges from the feature point to be checked to a ridge containing the virtual vicinal feature point, and when feature information about the virtual vicinal feature points matches in a predetermined range, it is determined that feature points to be checked contained in the first and the second fingerprints are same feature points.

34. (original) The method according to claim 31, wherein when said first and second fingerprints match in at least one of position, type, and direction of the virtual vicinal feature points, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

35. (original) The method according to claim 31, wherein when said feature points to be checked match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

36. (original) The method according to claim 31, wherein when said virtual vicinal feature points match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

37. (original) The method according to claim 31, wherein said virtual feature point is generated by projecting an existing feature point to a vicinal ridge.

38. (original) The method according to claim 37, wherein feature information about the virtual feature point is feature information about a feature point from which a virtual feature point is projected.

39. (original) The method according to claim 17, wherein when said feature points to be checked are different in type in said first and second fingerprints, a matching process is performed by changing relation between ridges containing the feature points to be checked and ridges containing the vicinal feature points.

40. (currently amended) A method for comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

generating a virtual feature point by referring to first and second feature points;

obtaining relations of a ridge containing a vicinal feature point near a feature point to be checked, and a ridge containing a virtual vicinal point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process, and performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process and comparing vicinal feature points of the first and second fingerprints, thereby determining whether or not the feature point to be checked is matching, and wherein when said first and second fingerprints match in ~~all~~at least one of position, type, and direction associated with a ridge direction of the vicinal feature points where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

41. (original) The method according to claim 40, wherein when said feature point to be checked matches in position and direction in said first and second fingerprints in a predetermined range, but does not match in type, evaluation of a matching result is set low.

42. (original) The method according to claim 40, wherein when said vicinal feature point or said virtual feature point matches in position and direction in a predetermined range in the first and second fingerprints, but does not match in type, evaluation of a matching result is set low.

43. (original) The method according to claim 42, wherein a matching process is performed on a combination of the vicinal feature point of said first and second fingerprint and the virtual feature point.

44. (original) The method according to claim 40, wherein when said first and second fingerprints match in feature points to be checked and said vicinal feature points match several times for the feature points to be checked, evaluation of a matching result is enhanced depending on a number of matching results.

45. (currently amended) A computer-readable storage medium storing a program for directing a computer to realize a method for comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

obtaining relation of a ridge containing a vicinal feature point near a feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing a feature point to be checked in the matching process; and

performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process and comparing vicinal feature points of the first and second fingerprints, and wherein when said first and second fingerprints match in at ~~all~~least one of position, type, and direction associated with a ridge direction of the vicinal feature points where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

46. (currently amended) A computer-readable storage medium storing a program for directing a computer to realize a method for comparing an obtained first fingerprint with a

preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

generating a virtual feature point by referring to first and second feature points;

obtaining a relation of the ridge containing a virtual vicinal feature point near a feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process and comparing vicinal feature points of the first and second fingerprints, and wherein when said first and second fingerprints match in ~~all at least one~~ of position, type, and direction associated with a ridge direction of the vicinal feature points where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

47. (currently amended) A computer-readable storage medium storing a program for directing a computer to realize a method for comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

generating a virtual feature point by referring to first and second feature points;

obtaining relations of a ridge containing a vicinal feature point near a feature point to be checked, and a ridge containing a virtual vicinal point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process, and performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process and comparing vicinal feature points of the first and second fingerprints, thereby determining whether or not the feature point to be checked is matching,

and wherein when said first and second fingerprints match in ~~all at least one~~ of position, type, and direction associated with a ridge direction of the vicinal feature points where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

48. (currently amended) A method of comparing first and second fingerprints, comprising:

identifying feature points of the first and second fingerprints in fingerprint ridges;

comparing feature point information of a target feature point of a ridge of the first fingerprint with a corresponding feature point of a ridge in the second fingerprint where the feature point information compared includes position, type and direction;

comparing the feature point information of feature points neighboring the target and corresponding feature points in corresponding ridges, respectively, in the first and section fingerprints; and

determining whether there is a match between the first and second feature points responsive to the comparisons with a match existing when there is a match in ~~all one of the~~ position, type and direction associated with a ridge direction in vicinal feature points where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point.

49. (cancelled)

50. (currently amended) A method of comparing first and second fingerprints, comprising:

identifying vicinal feature points of the first and second fingerprints in fingerprint ridges associated with a target feature point which is a feature point to be checked;

comparing position, type and direction of a ~~target~~-vicinal feature point in the first fingerprint with position, type and direction associated with a ridge direction of a corresponding vicinal feature point in the second fingerprint where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point; and

determining whether there is a match between the first and second vicinal feature points responsive to the comparison.

51. (cancelled)

52. (currently amended) A method, comprising:

identifying vicinal feature points of first and second fingerprints in fingerprint ridges associated with target feature points which are features point to be checked in the first and second fingerprints, respectively;

comparing ~~direction of~~ a target vicinal feature point in the first fingerprint with position, type and direction of a corresponding vicinal feature point in the second fingerprint where feature point direction is ridge direction when the feature point is an end point and a direction of a larger number of ridges when the feature point is a bifurcation point; ~~and~~

determining whether there is a match between the first and second vicinal feature points responsive to the comparison; and

indicating that the target feature points in the first and second fingerprints match responsive to the comparison.